

Programmable Attenuator

RC4DAT-6G-95

50Ω 0 – 95 dB, 0.25 dB step 1 to 6000 MHz

The Big Deal

- Four independently programmable channels
- Wide attenuation range, 95 dB
- Fine attenuation resolution, 0.25 dB(*)
- Short attenuation transition time (650 ns)
- Compact size, 5.17 x 3.00 x 0.85”
- **USB and Ethernet** control



Product Overview

Mini-Circuits' RC4DAT-6G-95 is a general purpose four channel programmable RF attenuator supporting frequencies from 1 to 6000 MHz with attenuation from 0 to 95 dB in each channel independently. Its unique design maintains linear attenuation change per dB, even at the highest attenuation settings. The attenuator is controlled via USB or Ethernet-TCP/IP connections and supports both HTTP and Telnet network protocols. It comes housed in a rugged, shielded metal case with input/output SMA(F) RF ports (input/output ports of each channel are interchangeable), a standard Ethernet port, and a USB type Mini-B power and control port.

The RC4DAT-6G-95 is supplied with our easy-to-install, user-friendly GUI software, API objects for Windows® environments, and complete programming instructions for 32 and 64 bit Windows® and Linux® operating systems. See p. 9 for a complete list of included accessories.

Key Features

Feature	Advantages
Ethernet control	The RC4DAT-6G-95 can be controlled from any Windows® or Linux® computer with a network connection using either HTTP or Telnet protocols, giving the user layout flexibility and freedom to operate a test setup remotely from almost anywhere.
USB control	The user may also control the RC4DAT-6G-95 via USB connection. The device draws all power requirements through the USB port.
Programmable attenuation sweep and Hop sequences	The RC4DAT-6G-95 can be programmed with a timed sequence of attenuation settings, to run without any additional external control
Plug-and-Play – no additional device drivers required.	Fast and easy setup and installation. The RC4DAT-6G-95 interfaces with various third-party software, making it easy to integrate into existing setups.
95 dB attenuation range.	The RC4DAT-6G-95 provides high-accuracy attenuation up to 95 dB, allowing the user precise level control over a broad attenuation and frequency range.
High linearity	Typical input IP3 of +54 dBm up to 6000 MHz

* See Specifications table (page 3) for details

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Programmable Attenuator

RC4DAT-6G-95

50Ω 0 – 95 dB, 0.25 dB step 1 to 6000 MHz

Features

- Four independently programmable channels
- USB and Ethernet control (HTTP and Telnet)
- Very good attenuation accuracy, ±0.4 dB typ.
- Short attenuation transition time (650 ns)
- Extremely low leakage
- Plug & Play device – no drivers required
- Supports a wide range of programming environments (See application note [AN-49-001](#) for details)



Installation CD

Case Style: QE2249

Included Accessories

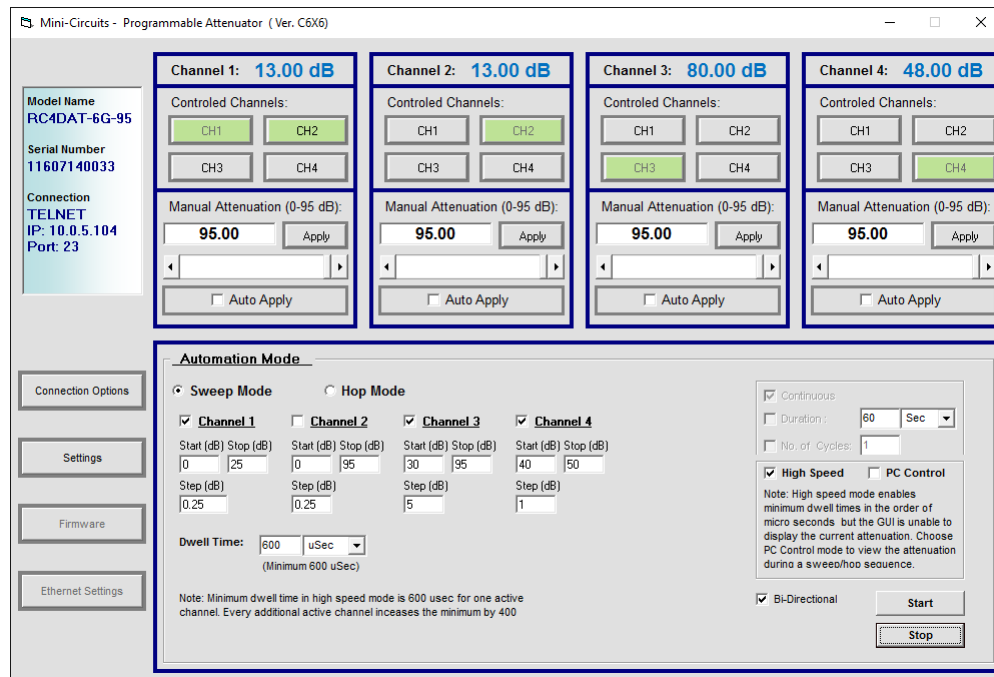
Model No.	Description	Qty.
USB-AC/DC-5	AC/DC 5V adapter	1
MUSB-CBL-3+	2.6 ft. USB cable	1
PC-DAT-CD	Software Installation CD	1

Applications

- MIMO test sets
- Automated Test Equipment (ATE)
- WiMAX, 3G, 4G, LTE, DVB Fading Simulators
- Laboratory Instrumentation / Production Test
- Handover system Evaluation
- Power level cycling

RoHS Compliant
See our web site for RoHS Compliance methodologies and qualifications

Mini-Circuits Graphical User Interface for RC4DAT-Series Programmable Attenuator



RC4DAT GUI screen in Sweep mode with channel 2 controlled by channel 1 (Ethernet control)

For programming instructions, see [programming guide](#) on Mini-Circuits' website.

Electrical Specifications ^{1,2} at 0°C to 50°C

Parameter	Frequency range	Conditions	Min.	Typ.	Max.	Units
Attenuation range	1 - 6000 MHz	0.25 dB step	0	-	90	dB
		0.5 dB step	90	-	95	
Attenuation accuracy ³	1 - 2000 MHz	@ 0.25 - 20 dB	-	±0.25	±(5.5% of nominal value+ 0.25)	dB
		@ 20.25 - 60 dB	-	±0.50	±(2% of nominal value+ 0.90)	
		@ 60.25 - 90 dB	-	±0.75	±(3.5% of nominal value+ 0.70)	
	2000 - 4000 MHz	@ 0.25 - 20 dB	-	±0.20	±(5.5% of nominal value+ 0.25)	
		@ 20.25 - 60 dB	-	±0.30	±(2% of nominal value+0.7)	
		@ 60.25 - 90 dB	-	±0.40	±(3% of nominal value+0.90)	
	4000 - 6000 MHz	@ 0.25 - 20 dB	-	±0.15	±(6.5% of nominal value+0.15)	
		@ 20.25 - 60 dB	-	±0.35	±(3.5% of nominal value+0.45)	
		@ 60.25 - 90 dB	-	±0.65	±(3.5% of nominal value+0.90)	
	1 - 6000 MHz	@ 90.5 - 95 dB	-	±0.90	±(6% of nominal value-1.35)	
Insertion Loss	1 - 2000 MHz	@ 0 dB	-	4.5	7.0	dB
	2000 - 4000 MHz		-	6.0	8.5	
	4000 - 6000 MHz		-	7.4	10.0	
Isolation In - Out (within a channel)	1 - 6000 MHz	Note 4	-	100	-	dB
Isolation (between channels)	1 - 6000 MHz	@ 0 - 90 dB	100	-	-	
Input operating power ⁵ (RF In and RF Out out ports)	1 - 10 MHz	@ 0 - 90 dB	-	-	Note 6	dBm
	10 - 6000 MHz		-	-	+23	
IP3 Input ⁷	1 - 3000 MHz	@ 0 dB setting	-	+55	-	dBm
	3000 - 6000 MHz	(P _{IN} =+10 dBm)	-	+52	-	
VSWR	1 - 500 MHz	@ 0 - 40 dB	-	1.15	-	:1
		@ 40.25 - 90 dB	-	1.05	-	
	500 - 4000 MHz	@ 0 - 40 dB	-	1.10	-	
		@ 40.25 - 90 dB	-	1.05	-	
4000 - 6000 MHz	@ 0 - 90 dB	-	1.3	-		
Min Dwell Time per channel ⁸	1 - 6000 MHz	High speed mode	-	600	-	µsec
Channel Synchronization ⁹	1 - 6000 MHz	Note 8	-	400	-	µsec
Attenuation Transition Time ¹⁰	1 - 6000 MHz	-	-	650	-	nsec
Supply Voltage	-	via USB port	4.75	5	5.25	V
USB current draw	-	-	-	190	250	mA
Ethernet communication	Supports both Telnet and HTTP protocols over TCP/IP with dynamic(DHCP) or static IP					

¹ Attenuator RF ports are interchangeable, and support simultaneous, bidirectional signal transmission, however the specifications are guaranteed for the RF in and RF out as noted on the label. There may be minor changes in performance when injecting signals to the RF Out port.

² RF performance specified per channel, performance of all four channels is identical.

³ Max accuracy defined as ±[absolute error+% of attenuation setting] for example when setting the attenuator to 80 dB attenuation the maximum error at 5000 MHz will be: ±(0.90+0.035x80)= ±(0.90+2.8)= ± 3.70 dB

⁴ Isolation In-Out is defined as max attenuation plus insertion loss; this is the path loss through the attenuator when initially powered up. After a brief delay (~0.5 sec typically) the attenuator will revert to a user defined "power-up" state (either max attenuation or a pre-set value).

⁵ Total operating input power per channel from both RF In and RF Out out ports. Compression level not noted as it exceeds max safe operating power level.

⁶ Derate linearly from +23 dBm at 50 MHz to +12 dBm at 1 MHz.

⁷ Tested with 1 MHz span between signals.

⁸ Minimum Dwell Time is the time the RC4DAT will take to respond to a command to change attenuation states in a channel without communication delays. In PC control add communication delays (on the order of msec for USB) to get actual response time.

⁹ Channel Synchronization is the delay between the first and last attenuator transitions beginning, in response to a command to set all channels.

¹⁰ Attenuation Transition Time is specified as the time between starting to change the attenuation state and settling on the requested attenuation state.

Absolute Maximum Ratings

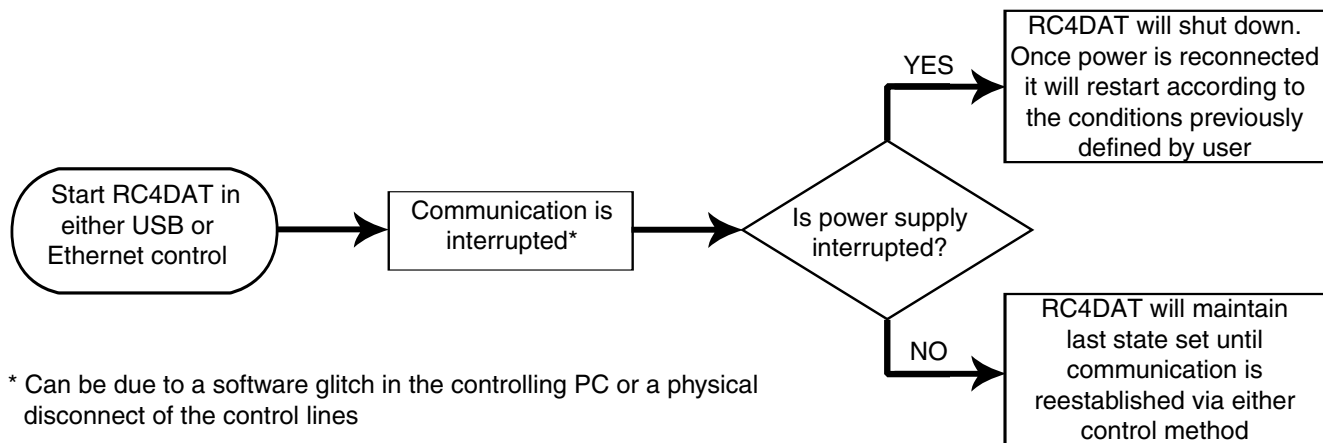
Operating Temperature	0°C to 50°C	
Storage Temperature	-20°C to 85°C	
V _{USB} Max.	6V	
Total RF power for RF In & RF Out	@ 1 to 50 MHz	Derate linearly from +12 dBm@ 1 MHz to +26 dBm@50 MHz
	@ 50 to 6000 MHz	+26 dBm

Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

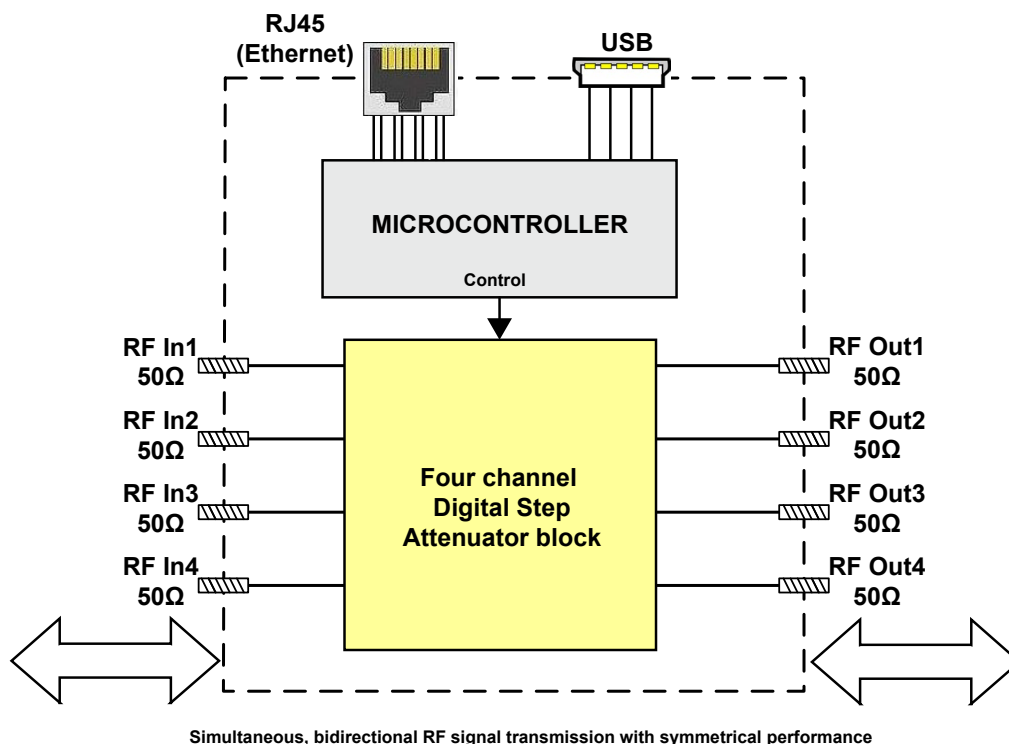
Minimum System Requirements

Interface	USB HID or HTTP Get/Post or Telnet protocols
Host operating system - USB Control	Windows 32/64 Bit operating system: Windows 98®, Windows XP®, Windows Vista®, Windows 7®, Windows 8®, Windows 10® Linux® support: 32/64 Bit operating system
Host operating system - Ethernet Control	Any Windows®, Mac®, or Linux® computer with a network port and Ethernet-TCP/IP (HTTP or Telnet protocols) support
Hardware	Pentium® II or better

RC4DAT response to communication interrupt



Block Diagram



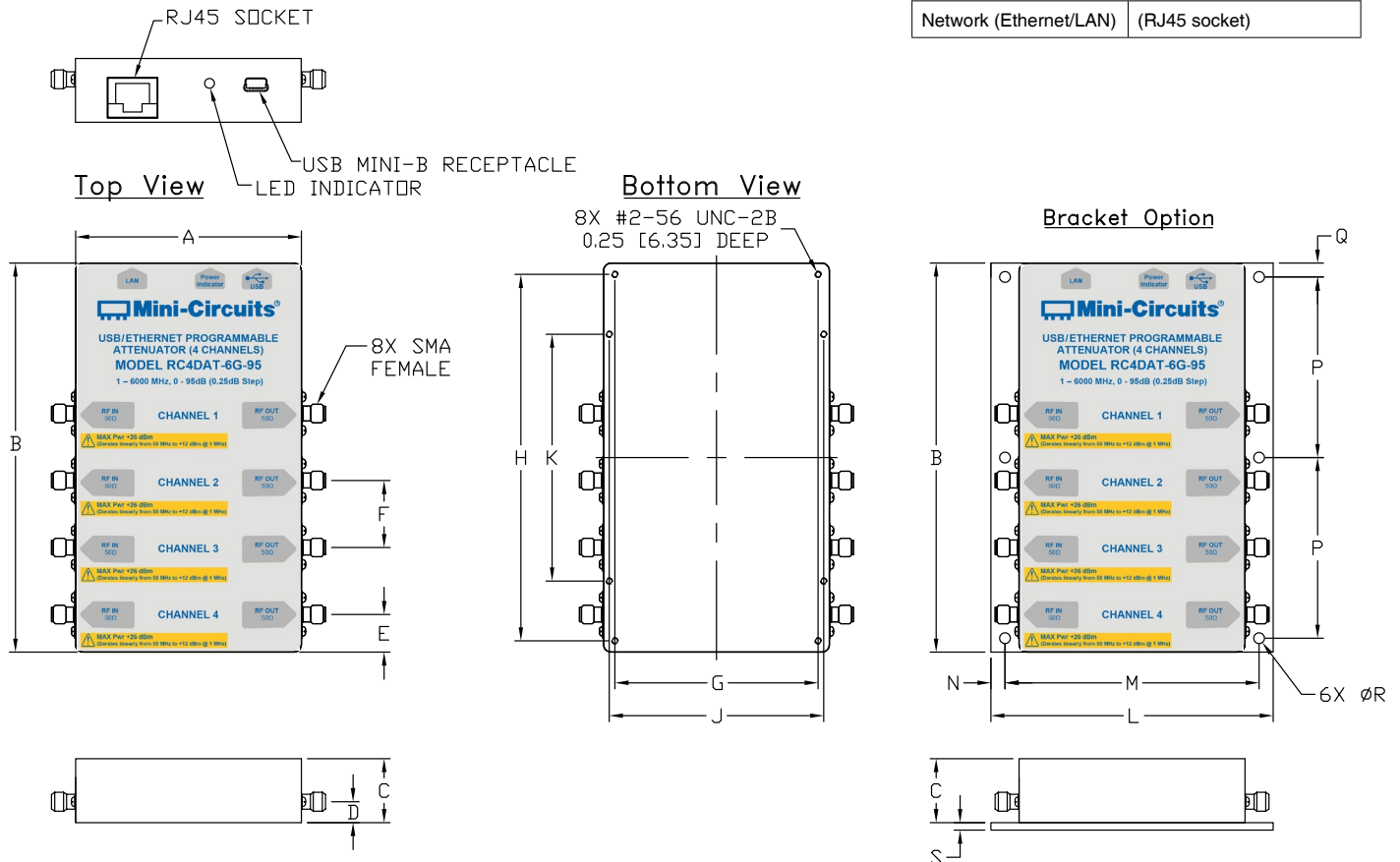
Connections

RF In 1,2,3,4	(SMA female)
RF Out 1,2,3,4	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)

Outline Drawing (QE2249)

Connections

RF IN 1, 2, ,3, 4	(SMA female)
RF OUT 1, 2, ,3, 4	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)



Instruction for mounting bracket:

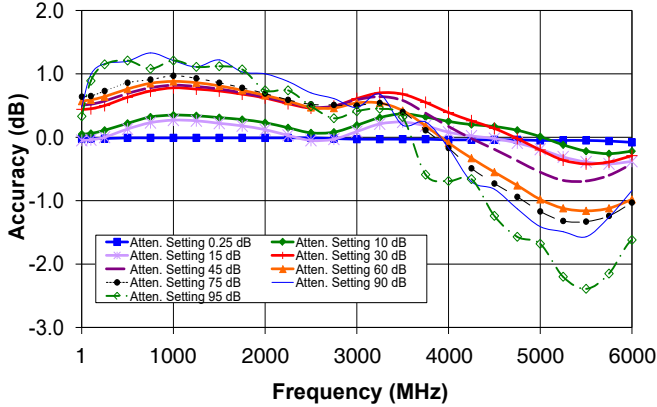
1. Tool required: Phillips head screwdriver
2. Mount the bracket over threaded holes on the bottom side with the fasteners provided with the bracket.

Outline Dimensions (inch mm)

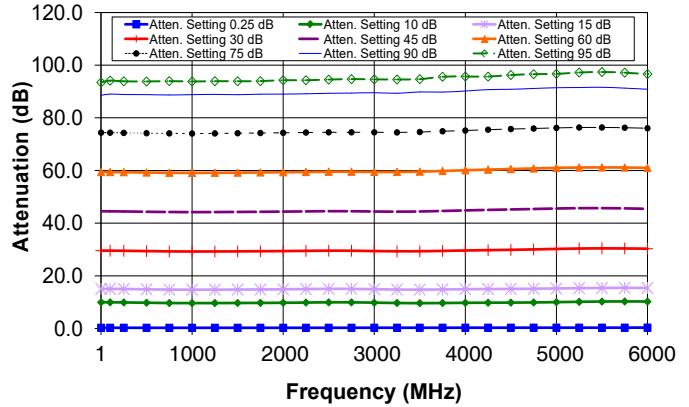
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	WT. GRAMS
3.00	5.17	0.85	0.28	0.50	0.89	2.700	4.870	2.850	3.280	3.75	3.375	0.188	2.400	0.185	0.144	0.100	0.185	200
76.2	131.3	21.6	7.1	12.7	22.6	68.58	123.7	72.39	83.31	95.25	85.72	4.76	60.96	4.70	3.66	2.54	4.70	

Typical Performance Curves

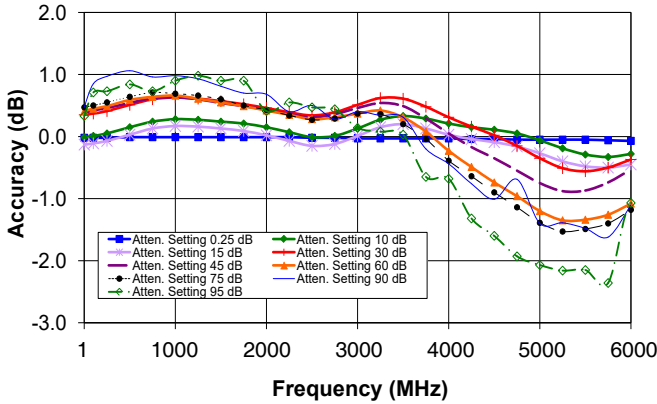
Attenuation Accuracy @ +25°C
vs. Frequency over Attenuation settings



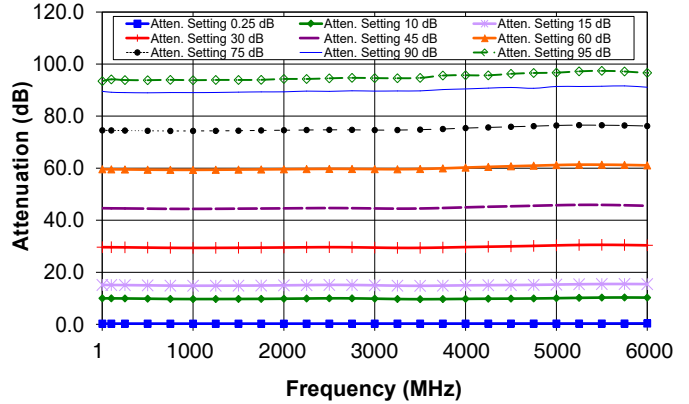
Attenuation relative to Insertion Loss @ +25°C
vs. Frequency over Attenuation settings



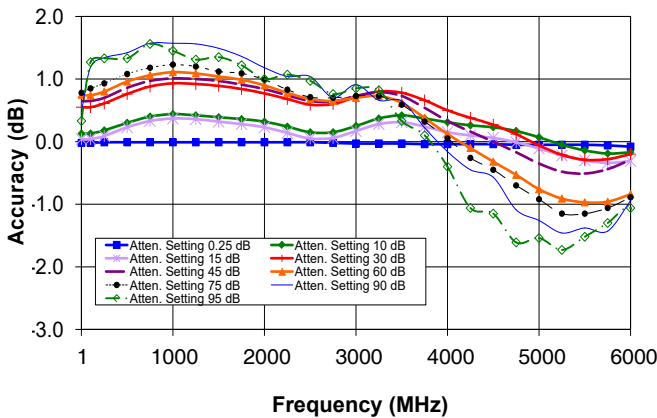
Attenuation Accuracy @ 0°C
vs. Frequency over Attenuation settings



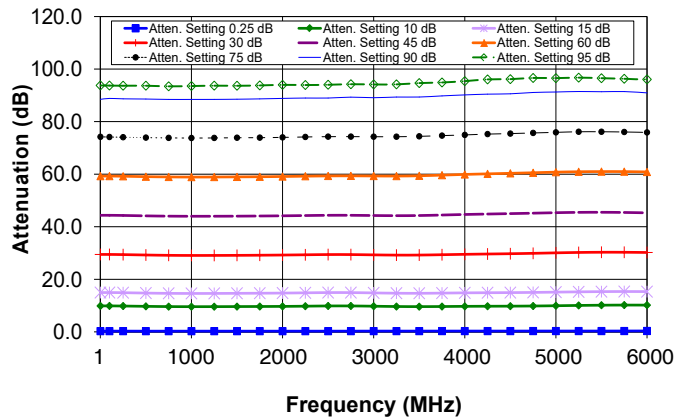
Attenuation relative to Insertion Loss @ 0°C
vs. Frequency over Attenuation settings



Attenuation Accuracy @ +50°C
vs. Frequency over Attenuation settings

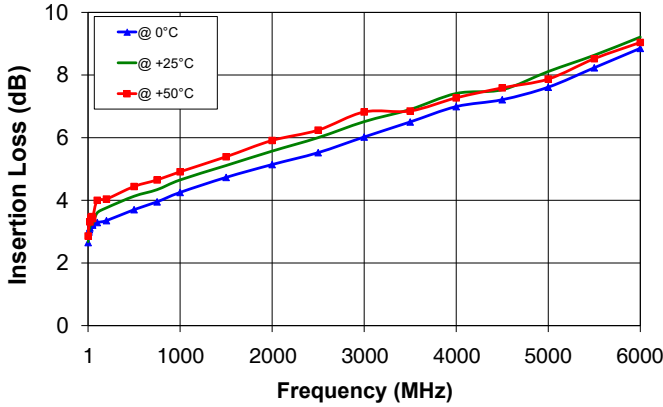


Attenuation relative to Insertion Loss @ +50°C
vs. Frequency over Attenuation settings

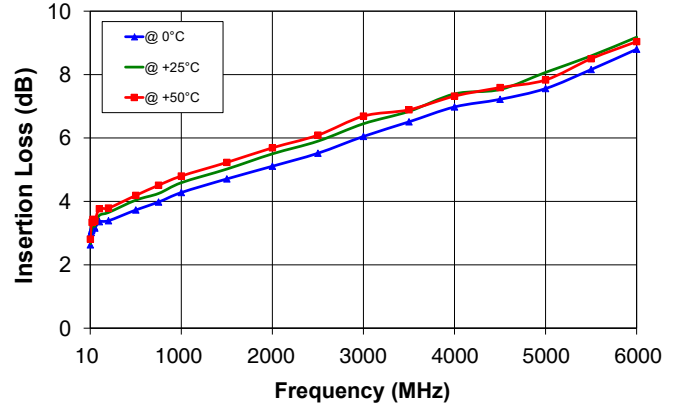


Typical Performance Curves (Continued)

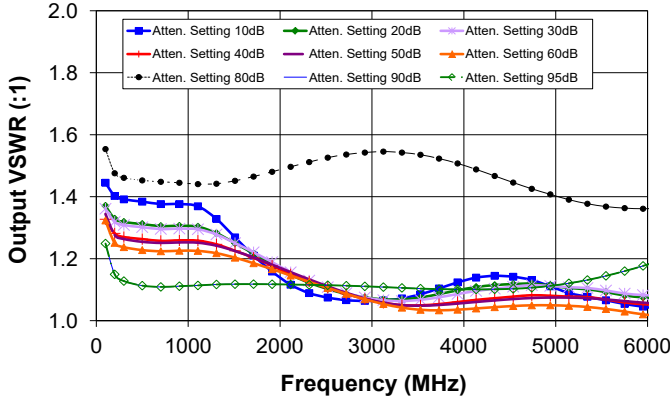
Insertion Loss @ Input Power 0dBm vs. Frequency over Temperatures



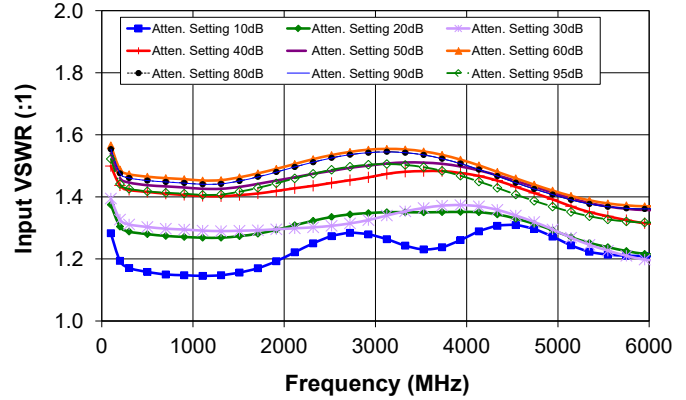
Insertion Loss @ Input Power +23 dBm vs. Frequency over Temperatures



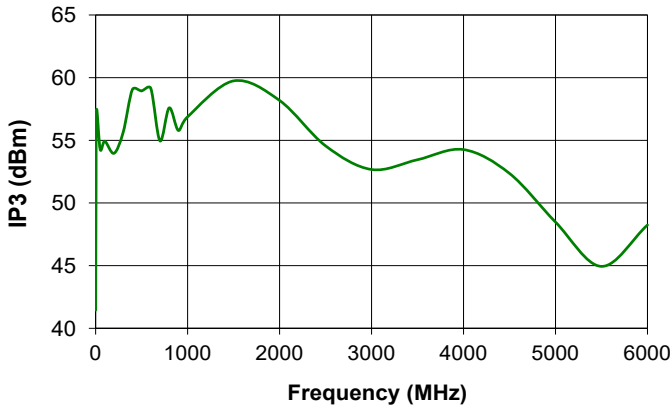
Output VSWR @ +25°C vs. Frequency over Attenuation settings



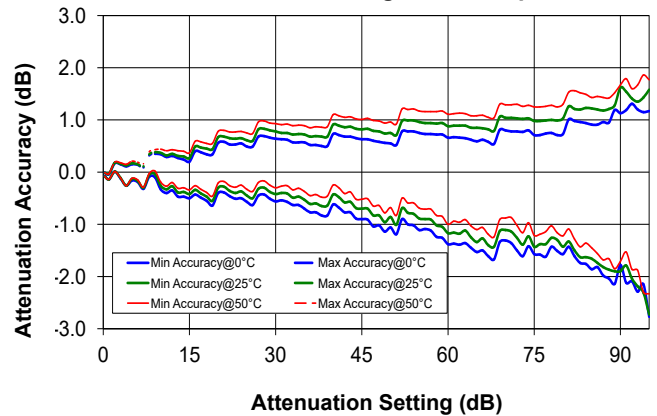
Input VSWR @ +25°C vs. Frequency over Attenuation settings



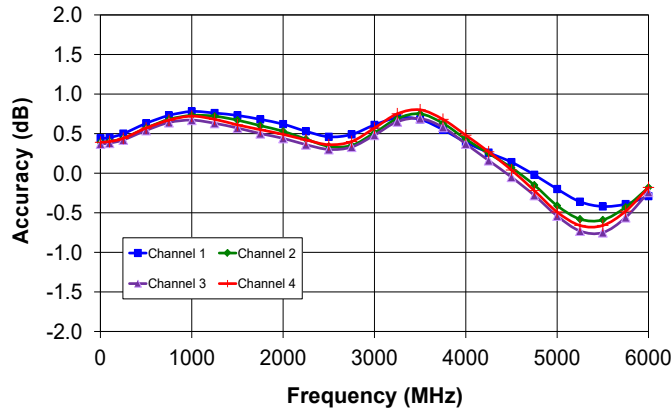
Input IP3 @ 0dB Attenuation vs. Frequency over Temperatures



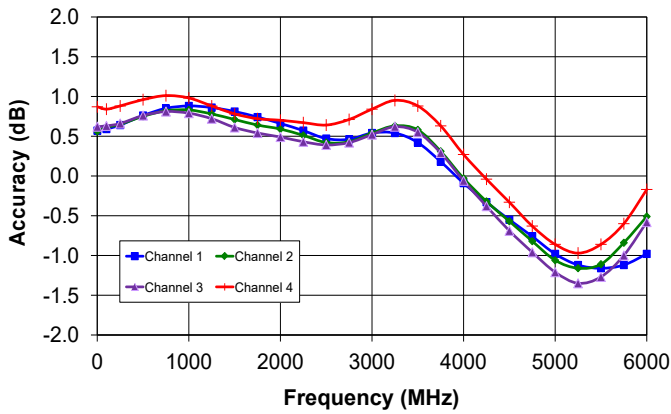
Typical Attenuation Accuracy vs. Attenuation settings over Temperature



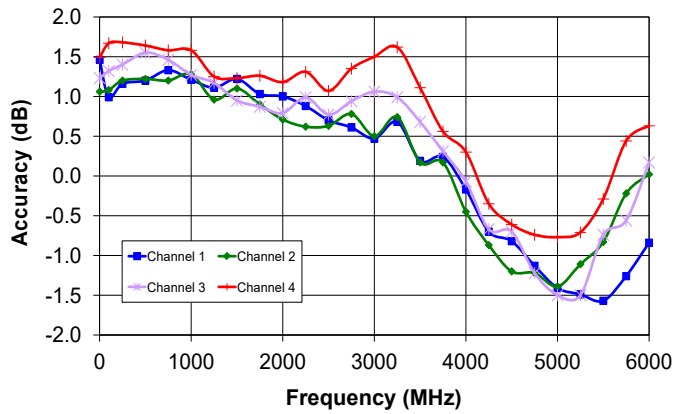
Attenuation Accuracy @ 30dB setting vs. Frequency at four channels



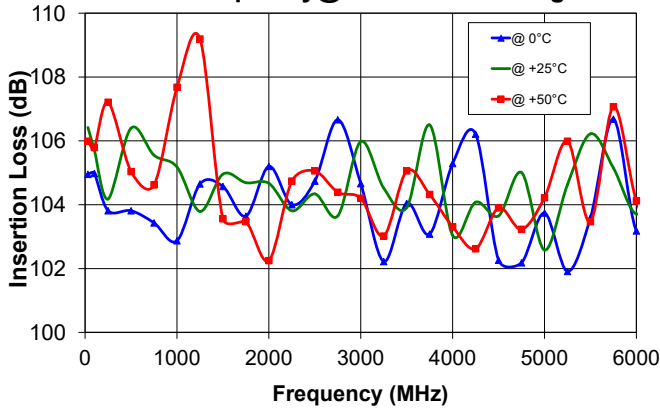
Attenuation Accuracy @ 60dB setting vs. Frequency at four channels



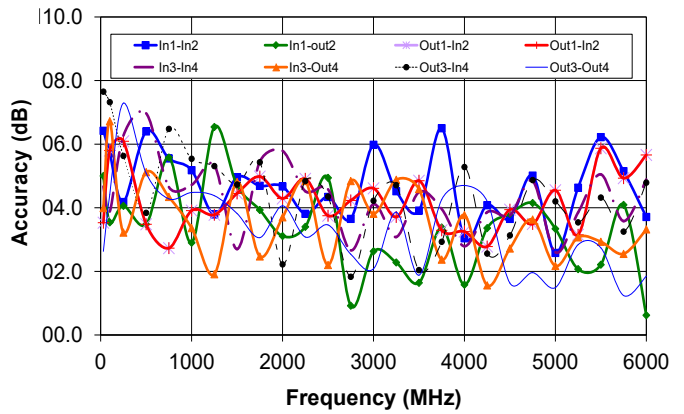
Attenuation Accuracy @ 90dB setting vs. Frequency at four channels



Isolation between RF In 1 and RF In 2 vs. Frequency @ 0dB atten. setting




Isolation between channels vs. Frequency



Ordering Information

Model	Description
RC4DAT-6G-95	USB/Ethernet four channel Programmable Attenuator

Included Accessories	Part No.	Description
	USB-AC/DC-5+	AC/DC Power Adapter with US, EU, IL, UK, AUS, and China two pin power plugs ^{12,13} . Operating temperature: 0°C to +45°C, AC Input: 100-240V, 47-63 Hz, DC Output 5±0.25 V, I _{Max} =1A
	PC-DAT-CD	Software CD
	MUSB-CBL-3+	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)

¹¹ The USB-AC/DC-5 may be used to provide the 5V_{DC} power input via USB port if operating the RC4DAT with Ethernet control. Not required if using USB control.

¹² Power plugs for other countries are also available, if you need a power plug for a country not listed in the table please contact apps@minicircuits.com or check <http://www.minicircuits.com/contact/offices.html> for regional offices e-mail and phone numbers.

Optional Accessories	Description
USB-AC/DC-5 (spare)	AC/DC 5V _{DC} Power Adapter with US, EU, IL, UK, AUS, and China power plugs
MUSB-CBL-3+ (spare)	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)
MUSB-CBL-7+	6.6 ft (2.0 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)
BKT-355-02+	Bracket kit including 3.75" x 5.17" bracket, mounting screws and washers

Additional Notes

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

